

CLAIMS:

1. A packaged semiconductor chip comprising:

(a) a first semiconductor chip having a front face, a rear face, edges bounding said faces and contacts exposed at said front surface;

(b) a second chip, said second chip having front and rear surfaces and contacts on said front surface, at least some of the contacts on said second chip being electrically connected to at least some of said contacts on said first chip, said front surface of said second chip facing upwardly and confronting a face of said first chip;

(c) a chip carrier disposed below said rear surface of said second chip, said chip carrier having a bottom surface facing downwardly away from said second chip and having a plurality of terminals exposed at said bottom surface for connection to a circuit panel, at least some of said terminals being electrically connected to at least one of said chips, said chip carrier further having an opening coinciding with at least a portion of said rear surface of said second chip, said opening being sized and disposed to coincide with a thermally conductive element of the circuit panel when said packaged semiconductor chip is mounted to the circuit panel.

2. An assembly including a packaged semiconductor chip as claimed in claim 1, said assembly further comprising:

a circuit panel mounted to said bottom surface of said chip carrier, said circuit panel including the thermally conductive element; and

thermally conductive material connecting said rear surface of said second chip to said thermally

conductive element of said circuit panel such that said rear surface of said second chip thermally communicates with said circuit panel through said thermally conductive material.

3. An assembly as claimed in claim 2 wherein said thermally conductive material includes solder.

4. An assembly as claimed in claim 2 wherein said thermally conductive material is provided from a thermally conductive paste.

5. A packaged semiconductor chip comprising:

(a) a first semiconductor chip having a front face, a rear face, edges bounding said faces and contacts exposed at said front surface, said first semiconductor chip including active components;

(b) a second chip, said second chip having front and rear surfaces and contacts on said front surface, at least some of the contacts on said second chip being electrically connected to at least some of said contacts on said first chip, said front surface of said second chip facing upwardly and confronting a face of said first chip;

(c) a chip carrier disposed below said rear surface of said second chip, said chip carrier having a bottom surface facing downwardly away from said second chip and having a plurality of terminals exposed at said bottom surface for connection to a circuit panel, at least some of said terminals being electrically connected to at least one of said chips, said chip carrier having a thermal conductor underlying at least a portion of said second chip, said thermal conductor having a surface

exposed at said bottom surface to provide thermal communication with a thermally conductive element of the circuit panel when said chip carrier is mounted to the circuit panel.

6. An assembly including a packaged semiconductor chip as claimed in claim 5, said assembly further comprising:

a circuit panel mounted to said bottom surface of said chip carrier, said circuit panel having a thermally conductive element in thermal communication with said thermal conductor of said chip carrier.

7. A packaged semiconductor chip as claimed in claim 5 wherein said thermal conductor is further in thermal communication with said first chip through said second chip.

8. A packaged chip as claimed in claims 1 or 5 wherein said second chip includes a plurality of passive electrical components.

9. A packaged chip as claimed in claim 7 comprising a plurality of said second chips.

10. A packaged chip as claimed in claims 1 or 5 further comprising one or more discrete passive electrical components being electrically connected to the terminals of said chip carrier.

11. A packaged chip as claimed in claims 1 or 5 further comprising a plurality of discrete passive

electrical components electrically connected to at least one of said chips.

12. A packaged chip as claimed in claim 1 wherein each of the faces of said first chip has a first area, wherein said opening of said chip carrier coincides with said rear surface of said second chip over a second area larger than said first area.

13. A packaged chip as claimed in claim 5 wherein each of the faces of said first chip has a first area, and wherein said thermal conductor is in thermal communication with said rear surface of said second chip over a second area larger than said first area.

14. A packaged chip as claimed in claims 1 or 5 wherein said rear face of said first chip faces downwardly towards said front surface of said second chip.

15. A packaged chip as claimed in claim 14 further comprising leads connecting at least some of the contacts of said first chip and at least some of said contacts of said second chip.

16. A packaged chip as claimed in claim 14 further comprising a thermally-conductive layer between said rear face of said first chip and said front face of said second chip.

17. A packaged chip as claimed in claims 1 or 5 wherein said front face of said first chip faces downwardly towards said front surface of said second chip.

18. A packaged chip as claimed in claim 17 wherein said contacts of said first chip are bonded to said contacts of said second chip, said first chip being in thermal communication with said second chip through said bonded contacts.

19. A packaged chip as claimed in claim 18 further comprising a thermally conductive underfill between said first and second chips, said first chip being in thermal communication with said second chip through said underfill.

20. A packaged chip as claimed in claims 1 or 5 wherein said chip carrier is a sheet-like element having thickness less than about 150 microns.

21. A packaged chip as claimed in claims 1 or 5 wherein said thermal conductor and said terminals are adapted for surface mounting to a circuit board.

22. A packaged chip as claimed in claims 1 or 5 wherein said first chip is a radio frequency amplifier chip.

23. A packaged semiconductor chip comprising:

(a) a first semiconductor chip having a front face, a rear face, edges bounding said faces and contacts exposed at said front surface;

(b) a second chip, said second chip having front and rear surfaces and contacts on said front surface, at least some of the contacts on said second chip aligned with and conductively connected to at least some of the contacts on said first chip, said front surface of said

second chip facing upwardly and confronting a face of said first chip;

(c) a chip carrier disposed below said rear surface of said second chip, said chip carrier having a bottom surface facing downwardly away from said second chip and having a plurality of terminals exposed at said bottom surface for connection to a circuit panel, at least some of said terminals being electrically connected to at least one of said chips; and

(d) an electrically and thermally conductive enclosure element overlying said first chip.

24. A packaged chip as claimed in claim 23 wherein said enclosure element is a hollow can having a rear wall overlying said first chip and having side walls extending downwardly to the vicinity of said chip carrier.

25. A packaged chip as claimed in claim 23 wherein said enclosure element substantially blocks radiative propagation of radio frequency energy between said first chip and a space outside said enclosure element.

26. A component for making a microelectronic assembly comprising:

a dielectric element having one or more bonding windows thereon;

a unitary metallic sheet adhering to said dielectric element, including an electrically continuous portion including a thermal conductor and one or more peripheral portions extending therefrom, and a plurality of terminals having leads formed integrally therewith, said unitary metallic sheet having openings therein, said

leads and active terminals being disposed in said openings such that said electrically continuous portion surrounds said leads and active terminals.

27. A component as claimed in claim 26 wherein said leads are attached to said electrically continuous portion through breakable connections, at least some of said breakable connections being aligned with said one or more bonding windows.

28. A component as claimed in claim 26 wherein said dielectric element includes a substantially planar layer adhering to said unitary metallic sheet.

29. A component as claimed in claim 26 further comprising an inductor including one or more conductors, said conductors attached to said electrically continuous portion through breakable connections, at least some of said breakable connections being aligned with said one or more bonding windows.

30. A component as claimed in claim 26 wherein said electrically continuous portion is substantially coextensive with said dielectric element.

31. A component as claimed in claim 26 wherein when said leads are bonded to a die, said breakable connections are broken such that said terminals and said leads are electrically isolated from said electrically continuous portion.

32. A component as claimed in claim 28 wherein said dielectric layer further includes a plurality of openings exposing a plurality of said terminals.

33. A component as claimed in claim 31 wherein said unitary metallic sheet further includes inactive terminals integrally formed with inactive leads, said inactive leads being attached at one end to said electrically continuous portion and through breakable connections at another end, at least some of said breakable connections being aligned with said one or more bonding windows.

34. An assembly including a component as claimed in claim 33, and

at least one first chip having front and rear faces and edges connecting said front and rear faces, said first chip further having a plurality of contacts on said front face, said rear face of said first chip being disposed in thermal communication with said thermal conductor of said unitary metallic sheet,

wherein said thermal conductor further has an area greater than any one of said active terminals.

35. An assembly as claimed in claim 34 wherein said electrically continuous portion provides a continuous conductive plane extending to edges of said assembly.

36. An assembly as claimed in claim 35 further comprising a second chip having front and rear surfaces and edges connecting said front and rear surfaces, said front surface facing said rear face of said first chip, said second chip further including a plurality of interior



contacts on said front surface aligned with and conductively connected to said contacts of said first chip.

37. An assembly as claimed in claim 36 wherein said first chip includes a passive chip including one or more passive devices, and said second chip includes an active chip including an active device.

38. An assembly as claimed in claim 36 wherein said first chip includes an active chip including an active device, and said second chip includes a passive chip including one or more passive devices.

39. An assembly as claimed in claim 38 wherein said passive chip has edges extending beyond said edges of said active chip.

40. An assembly as claimed in claim 39 wherein said passive chip further comprises a plurality of exterior contacts on said front surface remaining uncovered by said active chip, wherein

at least some of said exterior contacts being conductively connected to at least some of said active leads for which said breakable connections have been broken.

41. An assembly as claimed in claim 40 further comprising an electromagnetic shielding element disposed below a rear surface of said passive chip.

42. An assembly as claimed in claim 41 wherein said electromagnetic shielding element includes a metallic

enclosure bonded to said unitary metallic sheet, said metallic enclosure enclosing said active chip and said passive chip and substantially blocking radiative propagation of radio frequency energy between any of said active chip and said passive chip and a space outside said metallic enclosure.

43. A component as claimed in claim 26 wherein said leads project horizontally and inwardly from said terminals.

44. A component as claimed in claim 43 wherein said active leads extend upwardly above a top surface of said unitary metallic sheet.